

An Analysis Of Thinking Process In Solving Mathematical Problems Looking From The Personality Type In Blended Learning

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Abstract

The purpose of this study is to test the effectiveness of mathematical solving problems in a Blended Learning environment and to describe the students' thinking process of mathematical problem solving is looked from the personality type. This research is a mixed methods research with concurrent triangulation design. The results showed that : (1) Learning is implemented effectively with the fulfillment of criteria testing for the achievement of the Minimum Completion Criteria and classical completeness; (2) A student with ESTJ (Extrovert Sensing Thinking Judging) and INTJ (Introvert Intuition Thinking Judging) personality types tend to use the thinking process of forming understanding and opinions with the right and consistent and forming conclusions with precise but inconsistent. The types of ESTP (Extrovert Sensing Thinking Perceiving), ESFJ (Extrovert Sensing Feeling Judging) and ESFP (Extrovert Sensing Feeling Perceiving) tend to use the thinking process of forming understanding, opinions, and conclusions with the right and consistent results. ENFJ (Extrovert Intuition Feeling Judging) types tend to use the thinking process of forming understanding, opinions, and conclusions with precise but inconsistent results. ISTJ (Introvert Sensing Thinking Judging) types tend to use the thinking process of forming understanding and opinions with the right and consistent but have not used the thinking process of forming conclusions correctly. The personality types ISTP (Introvert Sensing Thinking Perceiving) and ISFJ (Introvert Sensing Feeling Judging) tend to use the thinking process of forming an understanding with the right and consistent, forming opinions with the right but have not used the thinking process of forming conclusions correctly.

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INTRODUCTION

Mathematics is a tool to develop a way of thinking (Hudojo, 2003). So, mathematics is very important to be studied in order to obtain a logical, rational, critical, careful, honest and effective way of thinking (Suherman, 2003). Mathematics will not be separated from problem-solving. Mathematics as a social institution resulting from human problem posing and solving (Ernest, 1991). Mathematics is the knowledge that used to solve the problem. According to Suherman (2003) problem solving is a very difficult mathematical activity both teaching and learning. A large amount of research has focused on solving mathematical problems. he focuses of his research includes the characteristics of the problem, the characteristics of successful students or students failing in problem-solving, earning strategies for solving possible solutions that can help students get to a successful group of students in problem-solving. Math anxiety also affects the ability of solving problem (Aunurrofiq & Junaedi, 2017; Ismawati, Masrukan, & Junaedi, 2015)

Problem-solving programs must be developed for natural situations and approaches that tend to be informal. In fact, many mathematics teachers teach without regard to this. Though teachers should be required to be able to interact and communicate effectively with students, the teacher does not only teach mathematics as a tool but teaches mathematics as a human activity. This is one of the factors that cause some students to have a negative impression on mathematics.

Teaching mathematics is a teaching activity so that students learn to get mathematics, which is the ability, skills, and attitudes about mathematics. The abilities, skills, and attitudes chosen by teaching must be relevant to the learning objectives and adapted to the cognitive structure of the students. This is intended for interaction between the teacher and the students (Hudojo, 1988). The interaction between teachers and students is often a problem in the knowledge transfer process. The teacher needs to know the thinking process of

students in working on problem-solving problems and student personality type as a provision and basic interaction with students.

In a development era of information and communication technology that is increasingly widespread, various kinds of learning support applications increasingly attract the attention of students as alternative learning materials. blended learning allows students to find the widest possible information online without leaving the interaction with the teacher. Identify personality types as supplies for interactions with students can use the Myers-Briggs Type Indicator (MBTI). The personality type that developed by Isabel Briggs Myers and Katherine Cooks Briggs based on a psychological theory by Carl Jung based on four main opposing dimensions (dichotomy) which is a representation of human nature. The research results of Harrington and Lorffredo (2010) show that personality types play an important role in the preference between online learning and face-to-face learning.

The purpose of this study is to test the effectiveness of mathematical problem solving with Problem Based Instruction (PBI) design in the Blended Learning environment and to describe the students' thinking process of mathematical problem solving looking from The Myers-Briggs Type Indicator (MBTI) personality type. MBTI divides personality types based on four main opposing dimensions (dichotomy) which is a representation of human nature, that is : (1) Dimension of concentration (Introvert /Extrovert), (2) Dimension of understanding information from outside (Sensing/Intuition), (3) Dimensions of drawing conclusions and decisions (Thinking/Feeling), (4) Dimensions of lifestyle (Judging/Perceiving)

METHOD

This research is a mixed methods research with concurrent triangulation design. Mixed methods is a research method that combines quantitative methods and qualitative methods to be used together in a research

activity so that more comprehensive, valid, reliable and objective data can be obtained (Sugiyono, 2016). Concurrent triangulation design is a combination research design where qualitative and quantitative data are obtained at one time, data are analyzed separately then compared or combined. Triangulation design is a combination research design method with the aim of obtaining different but complementary data to examine research problems with the same topic (Creswell, 2010).

Mixed methods with concurrent triangulation design chosen because the data obtained in this study consisted of qualitative and quantitative data. Each data is obtained at the same time and then analyzed to produce answers from different problem formulations in one research topic. Quantitative data is used to test the effectiveness of learning mathematical problem solving obtained from the value of the results of evaluation tests. Qualitative data is used to describe the thinking process of students in mathematical problem solving that received from the results of evaluation tests and interviews. The thinking process of mathematical problem solving is viewed from the student personality type so that previously a personality test was carried out in the form of filling out a questionnaire to determine the personality type. The research consisted of four stages that are: (1) preparation phase; (2) implementation phase; (3) data analysis phase; and (4) stage of making conclusions.

The preparation phase includes the preparation of learning devices, learning instruments, interview guides, and Myers-Briggs Type Indicators (MBTI) personality type questionnaires. Learning tools consist of the syllabus, learning implementation plan, student worksheets and grids of mathematical problem-solving questions. Learning instruments consist of tests for solving mathematical problems. In the preparatory phase, a Class selection is used as the research subject and the class will be used as a trial class for math problem-solving test questions.

The implementation phase begins with the implementation of a trial problem-solving

test in the trial class to determine which test questions can be used. Then a personality test was carried out using the Myers-Briggs Type Indicators (MBTI) questionnaire to classify the personality types of research subjects. The implementation of learning is carried out face to face and online. Face-to-face learning uses the Problem Based Instruction (PBI) learning model and online learning using the Edmodo application. At the end of the learning evaluation test was carried out and then interviews were conducted with selected subjects according to personality types.

Data analysis is carried out after the data is collected to answer the formulation of the problem that has been prepared. Make conclusions based on the results of data analysis carried out.

RESULTS AND DISCUSSION

The results of the normality test show that significance $> \alpha$ that is $0,22 > 0,05$, this means that data comes from populations that are normally distributed. The results of the achievement tests for minimum completeness criteria indicate that $t \geq t_{1-\alpha}$ which is $2,98 > 1,69$ so that the minimum completeness criteria are 75 achieved. The results of the classical completeness test show that $z_{count} \geq z_{table(0,5-\alpha)}$ that is $1,86 > 1,64$ so that classical completeness which is 75% is fulfilled. So that it can be said that learning that is applied is effective.

This is an inconsistency with various studies that apply PBI learning. The results of the study show that learning uses the PBI model effectively to improve students' problem-solving abilities (Fitra, Hajidin, & Anshari, 2016), effective and good to use in learning (Arifin, Kartono, & Hidayah, 2018; Eko Setiyono Riau & Junaedi, 2016) and mathematical problem solving abilities of students who get a Problem Based Instruction learning model are better than students who get a conventional learning model (Margana, 2016) even students' mathematical problem-solving abilities are better after PBI

models are applied. (Sahyuni, Yerizon, & Vionanda, 2012).

The results of this study are also consistent with various studies that use Blended learning in problem-solving. Research is carried out at various levels of education and The results of the study show that Blended learning based on problem-solving can develop students' mathematical communication skills so they are able to use mathematical ideas, understanding in solving mathematical problems as outlined in both oral and written (Riasari, 2018). Students in the blended learning class are better than ordinary classes, effectively used and have a significant positive impact (Dianawati, Kartono, & Wardono, 2018; Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018; Eryilmaz, 2015; Hasjiandito, Haryono, & Djuniadi, 2014; Lin, Tseng, & Chiang, 2017; Mutaqin, Marethi, & Syamsuri, 2016; Sulistiyoningsih, Kartono, & Mulyono, 2015). In addition, an effective blended learning environment is needed in carrying out an innovative pedagogical approach through the use of technology in teaching and learning (Kintu, Zhu, & Kagambe, 2017)

Students who are included in the ESTJ personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information obtained. Consistently through the process of forming opinions in solving mathematical problems appropriately by being able to write down and explain the plan that will be implemented and solve mathematical problems with plans made with the right results but it does not relate to the knowledge that has been previously owned. Through the process of forming conclusions in solving mathematical problems correctly. Of the three questions presented there are two questions that show the accuracy of students in undergoing the process of forming conclusions and checking again for the answers obtained. When given a question, students immediately read the questions and look for what is known and asked. Students submit a complete explanation, not connecting

questions with other material that has been studied.

The ESTJ personality type is included in the Sensing-Judging (SJ) personality type or Guardian according to Keirse. There is a match between the results of research with other studies that examine the thinking process, where the type of ESTJ or guardian can determine and write down what is known and asked, arrange problem-solving plans and solve it correctly but inconsistently where there are questions answered incorrectly. The stages are fully explained and checking the results in the process section (Aziz, Kusmayadi, & Sujadi, 2014; Putra, 2017; Sunarto, Budayasa, & Juniati, 2017).

The Research result of Putra (2017) indicates that the type of sensing personality or guardian associates elements that are known with prior knowledge. The difficulty of students' cognitive field dependent styles is problem-solving planning (Prasetya, Mulyono, & Rochmad, 2018). The research has the opposite results from the researchers found.

Students who are included in the ESTP personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information obtained. Consistently through the process of forming opinions in solving mathematical problems appropriately by being able to write down and explain the plan that will be implemented and solve mathematical problems with plans made with the right results. Consistently through the process of forming conclusions in solving mathematical problems correctly indicated by students making conclusions based on mathematical problems are given and checking again for the answers obtained. When getting a test question, students immediately look for the core of the problem and seem hasty, want to immediately solve the question indicated. ESTP type students do not like to linger reading questions and writing down how to work in detail. Tend to immediately get answers directly. ESTP type students have another way of thinking which is

to guess the answers so they can get results immediately, connect questions with material that knowledge that has been previously owned and After the results are found correction is made to the part of conformity with the problem and count.

The ESTP personality type is included in the Sensing-Perceiving (SP) personality type or Artisan according to Keirsey. The results of this study have matched the results with the results of the study of Sunarto et al (2017) that is, the Sensing-Perceiving (SP) personality type or Artisan emphasizes questions and captures the situation in the problem and masters the problem framework. Can explain what is known and ask and check the solution. However, there are also discrepancies in the results of research in which the results of the study of Sunarto et al (2017) show that subjects plan problem-solving not based on experience solving past problems but because of mastery of the problem itself.

Students who are included in the ENFJ personality type consistently through the process of forming an understanding in solving mathematical problems correctly by being able to understand and explain the information. Through the process of forming opinions in solving mathematical problems appropriately. Of the three questions shown, there are two questions that show the accuracy of students undergoing the process of forming opinions by being able to write down and explain the plan that will be implemented and solve mathematical problems with plans made with the right results. Through the process of forming conclusions in solving mathematical problems correctly. Of the three questions presented there are two questions that show the accuracy of students in undergoing the process of forming conclusions indicated by students making conclusions based on mathematical problems are given and checking again for answers obtained in the calculation section. After getting the questions, students then read the questions to completion and try to make a mathematical model of the problem-solving questions presented and plan a solution based on the knowledge that has been previously owned.

The ENFJ personality type is included in the Intuition-Feeling (NF) personality type or Idealist according to Keirsey. The results of the research conducted by Putra (2017) indicate the existence of conformity with the results of the research conducted, namely the Intuition-Feeling (NF) personality type or Idealist can mention and write down the elements known and asked. Can explain information obtained logically and associated elements that are known with prior knowledge. But there are also differences in research results that are intuition-Feeling (NF) or Idealist personality types can find other ways in their own ways because they are always confident in their abilities. Students test (apply) other ways they think they are right.

Students who are included in the ISTJ personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information obtained. Consistently through the process of forming opinions in solving mathematical problems appropriately by being able to write down and explain the plans that will be implemented and solve math problems with plans made with the right results. Students go through the process of forming conclusions in solving mathematical problems inappropriately. Students with the ISTJ personality type when given a question immediately read the questions and look for what is known and asked and check again on the count.

The ISTJ personality type is included in the personality type Sensing-Judging (SJ) or Guardian according to Keirsey. There is a match between the results of research with other studies that examine the thinking process, where the ISTJ type or guardian can determine and write down what is known and asked, arrange a plan to solve the problem and solve it correctly but not consistently where there are questions that are answered incorrectly. Connection elements that are known to previous knowledge and re-examine results in the process section (Aziz et al., 2014; Putra, 2017; Sunarto et al., 2017).

There is a difference with other studies where the results of the study are that most students with introverted personality types have difficulty in making mathematical models in the form of linear equations (Widayanti, 2016).

Students who are included in the ISTP personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information obtained. Through the process of forming opinions in solving mathematical problems appropriately, from the three questions that showed there are two questions that show the accuracy of students undergoing the process of forming opinions by being able to write down and explain the plans to be implemented and solve mathematical problems with plans made with the right results. Not through the process of forming conclusions in solving mathematical problems. Students connect questions with the knowledge that has been previously possessed.

The ISTP personality type is included in the Sensing-Perceiving (SP) personality type or Artisan according to Keirsey. The results of this study have matched the results with the results of the study of Sunarto et al (2017) that is, the Sensing-Perceiving (SP) personality type or Artisan emphasizes questions and captures the situation in the problem and masters the problem framework. Can explain what is known and ask and check the solution. However, there are also discrepancies in the results of research in which the results of the study of Sunarto et al (2017) show that subjects plan problem-solving not based on experience solving past problems but because of mastery of the problem itself.

There is also a mismatch with the introverted personality type thinking process research that is found that the majority of students with introverted personality types have difficulty in making mathematical models in the form of linear equations (Widayanti, 2016).

Students who are included in the INTJ personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information

obtained. Consistently through the process of forming opinions in solving mathematical problems appropriately by being able to write down and explain the plan that will be implemented and solve mathematical problems with plans made with the right results. Through the process of forming conclusions in solving mathematical problems correctly. From the three questions presented there are two questions that show the accuracy of students in undergoing the process of forming conclusions indicated by students making conclusions based on mathematical problems are given and checking again for answers obtained. When getting a question, immediately try to write down the completion and focus on the numbers, explain in full the complete steps and are inconsistent in carrying out the answer check and unsure of the answers written.

INTJ personality types are included in the Intuition-Thinking (NT) or Rational personality type according to Keirsey. The results of the study conducted by Aziz et al (2014) showed the existence of a match with the results of the research conducted that is the Intuition-Thinking (NT) personality type or the Rational mentions things that are known and asked, set steps to resolve problems and get problem-solving by developing ideas from previous answers. Re-check the resolution of the problem that has been done.

Students who are included in the ESFJ personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information obtained. consistently through the process of forming opinions in solving mathematical problems appropriately by being able to write down and explain the plans to be implemented and solve mathematical problems with plans that are made with the right results. Consistently through the process of forming conclusions in solving mathematical problems correctly which is shown by students making conclusions based on mathematical problems are given and checking again for answers obtained. When getting a question, immediately remember the

previous material that has been obtained or knowledge that has been known before and sure of the answers that have been written.

The ESFJ personality type is included in the personality type Sensing-Judging (SJ) according to Keirsey. There is a match between the results of research with other studies that examine the thinking process, where type SJ or guardian can determine and write down what is known and asked, arrange a problem-solving plan and solve it correctly but inconsistently where there are questions answered incorrectly. The stages are explained in full, linking the elements known to previous knowledge. and re-examine the results in the process section (Aziz et al., 2014; Putra, 2017; Sunarto et al., 2017).

Students who are included in the ESFP personality type consistently through the process of forming an understanding in solving mathematical problems appropriately by being able to understand and explain the information obtained. Consistently through the process of forming opinions in solving mathematical problems appropriately by being able to write down and explain the plans to be implemented and solve mathematical problems with plans that are made with the right results. Consistently through the process of forming conclusions correctly which is shown by students making conclusions and checking again. When getting a question then immediately try to solve the mathematical problems that are given and not connect the problem with the material or knowledge that has been previously possessed.

The ESFP personality type is included in the Sensing-Perceiving (SP) personality type or Artisan according to Keirsey. The results of this study have matched the results with the results of the study of Sunarto et al (2017) that is, the Sensing-Perceiving (SP) personality type or Artisan can explain what is known and asked and checking the solution. However, there are also discrepancies in the results of research in which the results of the study of Sunarto et al (2017) show that the Artisan Type emphasizes questions and captures the situation in the problem and controls the problem framework. Artisan types also plan problem-solving not

based on experience solving past problems but because of mastery of the problem itself.

Students who are included in the ISFJ personality type consistently through the process of forming an understanding in solving mathematical problems precisely by being able to understand and explain the information obtained. Through the process of forming opinions in solving mathematical problems appropriately. Of the three questions shown, there are two questions that show the accuracy of students undergoing the process of forming opinions by being able to write down and explain the plans to be implemented and solve mathematical problems with plans made with the right results. Not through the process of forming conclusions. When given a question immediately work but tend to not be confident in working because it works on other papers first. Do not connect questions with other material that has been studied and do not check the answers that have been written

The ISFJ personality type is included in the personality type Sensing-Judging (SJ) according to Keirsey. There is a match between the results of research with other studies that examine the thinking process, where type SJ or guardian can determine and write down what is known and asked, arrange a plan for problem-solving and solve it correctly but inconsistently where there are questions answered incorrectly. (Aziz et al., 2014; Putra, 2017; Sunarto et al., 2017).

However, there are also results that are contrary to similar research. In this study it was found that the ISFJ type did not connect the problem with the knowledge that was already possessed, but the results of Putra's research (2017) show that the sensing personality type or guardian associates the elements that are known with prior knowledge and the stages are fully explained and re-examine the results in the process section. Most students with introverted personality types have difficulty in making mathematical models in the form of linear equations (Widayanti, 2016)

CONCLUSION

Based on the results and discussion, conclusions are obtained as follows. Based on the result Learning is implemented effectively with the fulfillment of testing criteria for the achievement of the Minimum Completion Criteria that is 75 and classical completeness that is 75%

A student with ESTJ and INTJ personality types tend to use the thought process of forming an understanding and forming opinions with the right and consistent results and forming conclusions with precise but inconsistent results. The personality types of ESTP, ESFJ, and ESFP tend to use the thought process of forming an understanding, forming opinions and forming conclusions with the right and consistent results. ENFJ personality types tend to use the thought process of forming an understanding, forming opinions and forming conclusions with precise but inconsistent results. ISTJ personality types tend to use the thought process of forming an understanding and forming opinions with the right and consistent but have not used the thought process of forming conclusions correctly. The personality types ISTP and ISFJ tend to use the thought process of forming an understanding with the right and consistent results, forming opinions with the right but have not used the thought process of forming conclusions correctly.

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